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**WATER QUALITY
MEMORANDUM**
Utah Coal Regulatory Program

June 25, 2012

TO: Internal File

THRU: Steve Christensen, Permit Supervisor *SC*

FROM: Ken Hoffman, Hydrologist *KH*

RE: Fourth Quarter of 2011 Water Monitoring, Genwal Resources, Inc., Crandall Canyon Mine, C/015/0032, Task ID #3961

Water monitoring requirements for the Crandall Canyon Mine can be found in Sections 7.31.21, *Ground Water Monitoring Plan* and 7.31.22, *Surface Water Monitoring Plan*. Additional information can be found in Tables 7-4, 7-5, 7-8, 7-9 and 7-10.

Water encountered during mining operations was pumped to the portals and discharged to Crandall Creek under UPDES Permit No. UTU0024368. Discharges to Crandall Creek were within the limitations established by the permit with rare exceptions. Prior to 2008 only one sample reported an iron concentration greater than 1 mg/L (July 26, 2004 -1.08 mg/L). UPDES Permit No. UTU002438 was renewed on May 1, 2011 with a total iron maximum daily effluent limitation of 1.24 mg/L.

Following the mine collapse in August 2007, the pumps were removed from the mine and discharge ceased temporarily. From September 2007 through December 2007 water pooled within the mine, flooding the underground workings. In January 2008 the mine began discharging by gravity flow and has been discharging continuously since. The temporary seals placed in the portals following the collapse required modification to control the mine water discharge. Iron concentrations in the mine water discharge occasionally exceeded 1 mg/L from January to November 2008; and have been greater than 1 mg/L continuously since December 2008. Construction of a mine water treatment system began in December 2009 and was approved by the Division in January of 2010.

Since April of 2010, the mine water treatment system has proven effective in reducing total iron concentrations to within the 1.24 mg/L UPDES limit. Additionally, the Permittee began sampling the pre-treatment raw mine water (Pre 002) in April of 2010. The sampling of the raw mine water is conducted in an effort to monitor changes in mine water chemistry that might indicate what (if any) changes are occurring to the iron concentrations. To date, the total iron concentration in the raw mine-water remains above 1.24 mg/L.

1. Was data submitted for all of the MRP required sites? YES NO

Springs

The approved MRP requires the monitoring of 24 springs each quarter. Of these 24 springs, 9 require laboratory water quality analysis (See Table 7-4). The remaining 15 springs require quarterly monitoring of field parameters (flow, pH, specific conductance and temperature).

Streams

The approved MRP requires the monitoring of 12 surface water/stream sites. Of these 12 surface water/stream sites, 9 require laboratory water quality analysis (See Table 7-8). The remaining 3 sites require quarterly monitoring of field parameters (flow, pH, specific conductance, temperature and dissolved oxygen).

Wells

The approved MRP outlines monitoring of 7 wells. According to Table 7-4, all 7 wells required quarterly laboratory water quality analysis. However, due to the mine disaster on August 6th, 2007, the active mine-workings have been sealed thus rendering the wells inaccessible.

UPDES

The UPDES Permit/MRP (UT000024368) requires monthly monitoring of 2 outfalls: 001 and 002. Outfall 001 is associated with the discharge from the primary sediment pond at the main mine facility. Outfall 002 is associated with the mine-water discharge that reports directly to Crandall Creek.

The required data was submitted for Outfalls 001 and 002.

Pre-Treatment Mine Water Discharge

As part of the permitting process for the mine-water treatment system (Appendix 7-65), the Permittee has committed to monthly sampling of the pre-treatment mine water discharge for the following parameters:

- Iron (total, dissolved and ferrous)
- Manganese (total and dissolved)
- Aluminum (total and dissolved)
- Alkalinity
- Sulfate
- pH
- Dissolved Oxygen

The required Monthly data was collected for the pre-treatment mine water discharge and submitted to the EDI.

2. Were all required parameters reported for each site? YES NO

Springs

All required parameters were reported for the surface water monitoring sites that were accessible and produced a measurable flow.

Streams

All required parameters were reported for the surface water monitoring sites that produced a measurable flow.

Wells

NA- Since the mine collapse in August of 2007, the monitoring wells are inaccessible.

UPDES

Outfall No. 002 discharged everyday of the quarter and was sampled each month during discharge as required by the UPDES discharge permit. All required parameters were reported for Outfalls 001 and 002.

As part of the approval for the mine-water treatment system (Appendix 7-65), the Permittee committed to obtain additional monthly samples for Outfall 002. The parameters include (D-Fe, FE2+, T-Mn, D-Mn, T-Al, D-Al, Alkalinity and Sulfate). Concentrations were reported for each of the additional parameters at Outfall 002.

Pre-Treatment Mine Water Discharge

As discussed above, monthly sampling of the Pre-Treatment Mine Water Discharge became a requirement with the approval of the mine-water discharge treatment system. The required pre-treatment mine discharge parameters were reported this quarter as required.

3. Were any irregularities found in the data? YES NO

Springs

The following springs had the listed parameters were more than two standard deviations from the mean:

LB-12 October: specific conductivity
Little Bear Spring December: acidity, total dissolved solids
SP-58 October: total hardness
SP-79 November: dissolved sodium
SP1-33 October: bicarbonate, dissolved magnesium
SP1-47 October: specific conductivity

Streams

The following streams listed parameters were more than two standard deviations from the mean:

IBC-1 November: specific conductivity, dissolved sodium
Indian Creek October: total hardness, dissolved potassium
Little Bear Creek October: (dry at monitoring site, monitored about 60 ft above) dissolved magnesium, total hardness, total dissolved solids, specific conductivity, dissolved sodium
Section 4 Creek November: specific conductivity
UPF-1 November: total dissolved solids

As the total iron concentrations in the mine-water discharge began to increase, a concern was that a similar rise would be observed in stream monitoring site LOF-1 (lower Crandall Canyon flume). An upward trend of total iron began to surface the second quarter of 2008 in correspondence with the increase in iron concentrations of the mine-water discharge. A total iron concentration of 1.479 gm was reported the fourth quarter of 2009. Once the mine-water treatment system became operational during the First Quarter of 2010, the iron concentrations detected at LOF-1 have dropped significantly. The total iron concentration for LOF-1 this quarter was non-detect or less than 0.05 mg/L.

UPDES Sites (001 and 002)

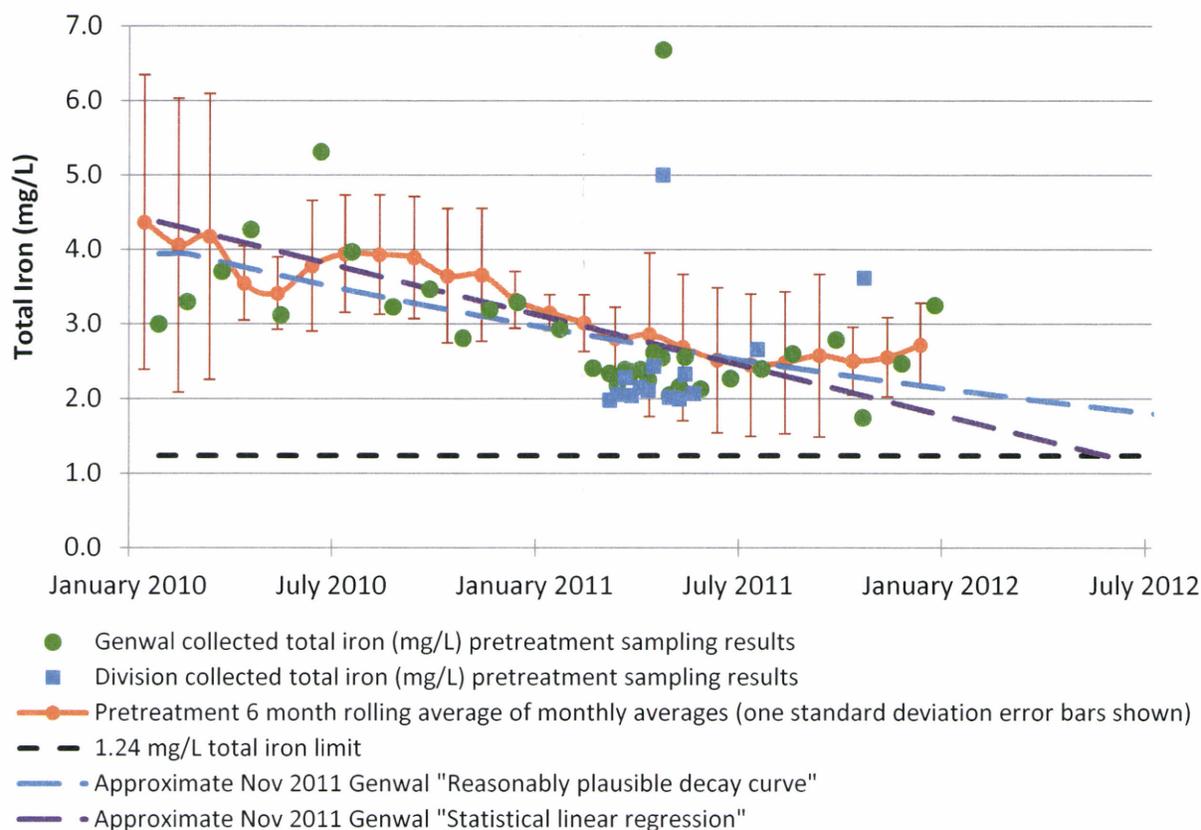
Based upon three sampling events, Outfall 002 reported an average flow value of 411 gpm. The total iron concentrations of the water discharging from the mine-water treatment basin were well within the 1.24 mg/L standard established by the UPDES permit. The mine-water treatment system continues to be effective in reducing the total iron concentrations to within the UPDES discharge permit limit of 1.24 mg/L.

The toxicity identification evaluation (TIE) initiated in during the Third Quarter of 2011 was continued in the Fourth Quarter of 2011. Whole effluent toxicity (WET) testing was conducted during the Fourth Quarter of 2011 and was found to be non-toxic and the TIE was ceased.

Pre-Treatment Mine Water Discharge

The total iron concentrations in the pre-treatment mine water remain well above the 1.24 mg/L UPDES limit. Based on three sampling events the resulting concentrations for total iron were 1.75, 2.47, and 3.25 mg/L for July, August, and September, respectively. In addition, the Division collected one sample in October 2011 for total iron resulting in a concentration of 3.62 mg/L. The data show that total iron concentration still remains variable but since January 2010 to March 2011 a downward trend occurred. However since March 2011 the concentration of total iron has begun to level off around 2.5 mg/L. It remains undetermined whether the concentration of total iron will decrease below the total iron maximum daily effluent limitation of 1.24 mg/L is yet to be demonstrated. In addition, total dissolved solids and dissolved sodium in December were found to be more than two standard deviations from the mean.

Below is a graph of the pretreatment total iron concentration since January 2010. The graph shows the measured total iron concentration and rolling 6 month average total iron concentration (including one standard deviation error bars) compared to the curves generated in the November 2011 *Investigation of Iron Concentration in the Genwal Resources, Inc. Crandall Canyon Mine Discharge Water* by Petersen Hydrologic, LLC report.



4. On what date does the MRP require a five-year re-sampling of baseline water data.

Page 7-33 of the MRP states that groundwater samples collected during the low flow period (typically the 4th quarter) every 5 years will be analyzed for baseline parameters (See Tables 7-5). Baseline sampling was conducted this quarter. All required baseline parameters were reported for all ground and surface water monitoring points.

Page 7-35 of the MRP states that surface water samples collected during the low flow period every 5 years will be analyzed for baseline parameters (See Table 7-9). The Fourth Quarter of 2015 will be the next sampling event where baseline data will be required.

5. Based on your review, what further actions, if any, do you recommend?

Continued data collection and monitoring of the mine-water discharge will be necessary to evaluate the effectiveness of the mine-water treatment system. Monitoring of the pre-treatment mine-water will help determine the overall chemistry of the raw mine-water and help determine if the total iron concentrations are showing any change in concentration. To this end it is critical to maintain on time submittal of the pretreatment and Outfall 002 sampling results to DOGM, as required by Appendix 7-65.